

## CLAIMS

- Sub  
a67
1. A polarization mode dispersion compensating apparatus, comprising:  
a polarization mode dispersion compensator optically coupled to an input port and receiving an input optical signal having polarization mode dispersion and a wavelength dither, said polarization mode dispersion compensator having a variable polarization mode dispersion;  
a polarimeter optically coupled to the output of said polarization mode dispersion compensator and outputting an electrical signal representing polarization states of the optical signal; and  
a controller operatively coupled to said polarimeter and said polarization mode compensator, said controller receiving the electrical signal from said polarimeter;  
said controller controlling said polarization mode dispersion compensator according to the electrical signal to compensate for the polarization mode dispersion of the input optical signal.
2. The polarization mode dispersion compensating apparatus according to claim 1, further comprising;  
a signal source for generating the input optical signal with the wavelength dither, wherein the input optical signal is transmitted across optical fiber and/or components that cause the input signal to have the polarization mode dispersion.
3. The polarization mode dispersion compensating apparatus according to claim 1, said polarimeter including:  
a first polarizer optically coupled to said polarization mode dispersion compensator, said first polarizer plane polarizing an optical signal output from said polarization mode dispersion compensator at first polarization angle;  
a second polarizer optically coupled to said polarization mode dispersion compensator, said second polarizer plane polarizing an optical signal output from said polarization mode dispersion compensator at a second angle different than the first angle;

09697703.103700

a third polarizer optically coupled to said polarization mode dispersion compensator, said third polarizer circularly polarizing an optical signal output from said polarization mode dispersion compensator;

a first photodetector optically coupled to said first polarizer and outputting a first detection signal;

a second photodetector optically coupled to said second polarizer and outputting a second detection signal; and

a third photodetector optically coupled to said third polarizer and outputting a third detection signal.

4. The polarization mode dispersion compensating apparatus according to claim 1, said controller controlling said polarization mode dispersion compensator so as to minimize a sum of the squares of the first, second and third detection signals to compensate for the polarization mode dispersion of the input optical signal.

5. The polarization mode dispersion compensating apparatus according to claim 1, said polarization mode dispersion compensator including:

a polarization controller optically coupled to the input port and receiving the input optical signal;

a first birefringent component optically coupled to said polarization controller;

a variable retarder optically coupled to said first birefringent component; and

a second birefringent component optically coupled to said variable retarder;

said controller operatively coupled to said polarimeter, said variable retarder and said polarization controller;

said controller controlling said variable retarder and said polarization controller according to the electrical signal to compensate for the polarization mode dispersion of the input signal.

09697031.102700

6. The polarization mode dispersion compensating apparatus according to claim 1, said polarimeter including:
- a first polarizer optically coupled to said second birefringent component, said first polarizer plane polarizing an optical signal output from said second birefringent component at an angle parallel to an optic axis;
  - a second polarizer optically coupled to said second birefringent component, said second polarizer plane polarizing an optical signal output from said second birefringent component at an angle not parallel to the optic axis;
  - a third polarizer optically coupled to said second birefringent component, said third polarizer plane circularly polarizing an optical signal output from said second birefringent component;
  - a first photodetector optically coupled to said first polarizer and outputting a first detection signal;
  - a second photodetector optically coupled to said second polarizer and outputting a second detection signal; and
  - a third photodetector optically coupled to said third polarizer and outputting a third detection signal.
7. The polarization mode dispersion compensating apparatus according to claim 6, said controller controlling said polarization mode dispersion compensator so as to minimize a sum of the squares of the first, second and third detection signals to compensate for the polarization mode dispersion of the input optical signal.
8. The polarization mode dispersion compensating apparatus according to claim 5, wherein said polarization controller and said retarder are integrated electrooptic waveguide devices or liquid crystal components.
9. The polarization mode dispersion compensating apparatus according to claim 4, said controller utilizing an adaptive learning algorithm to further minimize the sum of the squares of the first, second and third detection signals and further compensate for the polarization mode dispersion of the input optical signal.

09697703-102700

10. A wavelength division multiplexed optical communication system, comprising:  
a plurality of optical transmitters, each emitting a corresponding one of a plurality of optical signals, each of the plurality of optical signals being at a respective one of a plurality of wavelengths and having a respective wavelength dither;

an optical combiner having a plurality of inputs, each of which being coupled to a respective one of said plurality of optical transmitters, and an output supplying the plurality of optical signals to a first end portion of an optical communication path;

an optical demultiplexer having an input configured to be coupled to a second end portion of the optical communication path, and a plurality of outputs, each of the plurality of outputs of said optical demultiplexer supplying a respective one of the plurality of optical signals;

a plurality of polarization mode dispersion compensating apparatuses according to claim 1, each of which being coupled to a respective one of the plurality of outputs of said optical demultiplexer;

a plurality of optical receivers, each of which being coupled to a respective one of the plurality of outputs of said polarization mode compensating apparatuses.

11. The wavelength division multiplexed optical communication system according to claim 10, further comprising:

a plurality of optical amplification devices arranged in series along the optical communication path.

09697703.102700

12. A method of compensating an optical signal having polarization mode dispersion, comprising:

dithering a wavelength of the optical signal so as to vary around a center wavelength;

compensating the polarization mode dispersion of the optical signal with a variable polarization mode dispersion compensator;

polarizing an optical signal output from the variable polarization mode dispersion compensator to generate polarized component optical signals;

detecting polarized component optical signals to generate detection signals; and

controlling said compensating step according to the detection signals.

13. The method of compensating an optical signal having polarization mode dispersion according to claim 12,

said polarizing step including subjecting the optical signal output from the variable polarization mode dispersion compensator to plane polarization at a first polarization angle, plane polarization at a second angle different than the first angle, and circular polarization; and

said detecting step detecting the three polarized optical signals to output a first, second and third detection signal.

14. The method of compensating an optical signal having polarization mode dispersion according to claim 13,

said controlling step controlling said compensating step according to the first, second, and third detection signals.

15. The method of compensating an optical signal having polarization mode dispersion according to claim 14,

said controlling step minimizing a sum of the squares of the first, second, and third detection signals.

09697703.103700

16. The method of compensating an optical signal having polarization mode dispersion according to claim 15,

said controlling step adaptively learning to minimize the sum of the squares of the first, second, and third detection signals.

17. The method of compensating an optical signal having polarization mode dispersion according to claim 12,

said compensating step including:

changing principal polarization states of the optical signal;

inputting the optical signal from said controlling step to a first polarization mode compensating element;

retarding a phase angle of principal polarization states of the optical signal output from the first polarization mode compensating element; and

inputting the optical signal from said retarding step to a second polarization mode compensating element;

said polarizing step including subjecting the optical signal output from the variable polarization mode dispersion compensator to plane polarization at a first polarization angle, plane polarization at a second angle different than the first angle, and circular polarization; and

said detecting step detecting the three polarized optical signals to output a first, second and third detection signal.

said controlling step controlling said changing step and said retarding step according to the first, second, and third detection signals.

18. The method of compensating an optical signal having polarization mode dispersion according to claim 17,

said controlling step minimizing a sum of the squares the first, second, and third detection signals.

19. A polarization mode dispersion compensating system, comprising:

0969703-102700

a polarization mode dispersion compensator optically coupled to an input port and receiving an input optical signal having polarization mode dispersion, said polarization mode dispersion compensator having a variable polarization mode dispersion;

a Q detector operatively coupled to said polarization mode dispersion compensator, said Q detector outputting an electrical signal representing an edge sharpness of the optical signal output from said polarization mode dispersion compensator; and

a controller operatively coupled to said Q detector and to said polarization mode dispersion compensator, said controller receiving the electrical signal from said Q detector;

said controller controlling said polarization mode dispersion compensator to minimize the Q represented by the electrical signal to compensate for the polarization mode dispersion of the input signal.

20. The polarization mode dispersion compensating system according to claim 19, said polarization mode compensator including

a polarization controller optically coupled to the input port and receiving the input optical signal having the polarization mode dispersion;

a first birefringent component optically coupled to said polarization controller;

a variable retarder optically coupled to said first birefringent component;

and

a second birefringent component optically coupled to said variable retarder;

said controller operatively coupled to said Q detector, said variable retarder and said polarization controller, said controller receiving the electrical signal from said Q detector;

said controller controlling said variable retarder and said polarization controller to minimize the Q represented by the electrical signal to compensate for the polarization mode dispersion of the input signal.

05697703.102700

add  
ab

09697703.102700